SCRRBA

Southern California Repeater and
Remote Base Association
P.O. Box 5967
Pasadena, California 91117

In the Matter Of:)
)
Spectrum reallocation in the 2.30) **ET Docket No. 94-32**
32
through 2.45 GHz Frequency bands)
Of spectrum transferred from)
Federal Government Use)

Re: Reallocation from Government service to Non-Government service of spectrum shared with the Amateur Radio Service.

June 14, 1994

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List A B C D E

The Southern California Repeater and Remote Base Association (SCRRBA) is a voluntary association of owners and operators of Amateur Radio Service fixed and mobile relay stations operating primarily on the UHF and Microwave Frequency amateur bands. SCRRBA has provided frequency coordination for these activities since 1970. SCRRBA has actively participated in numerous Federal Communications Commission rule making proceedings pertinent to our activities.

SCRRBA currently maintains over 2,000 frequency coordination records. These data represent the activities of approximately 600 relay type amateur radio systems in Southern California. All of these systems operate on the UHF (420 MHz) and higher amateur frequency bands. These systems each have an average membership of about 50 amateurs. The largest of these systems has a membership exceeding 1,300.

SCRRBA is an active participant (usually the sponsor) in the amateur band planning process. We represent the fixed and mobile relay interests in regional band planning meetings. These meetings occur when the existing plans do not cover a desired activity, or when they need to be upgraded to match new or increased activities. These meetings are attended by representatives of ALL the amateur uses of the band. These band plans are adopted by unanimous consent of these representatives. These band plans cover activity in the Southern California region. In 1992, we met and developed a new set of band plans for the 2.3 GHz and microwave amateur bands. The band plan we developed for 2.3 GHz replaced one adopted in 1980. That plan became unusable for most point-to-point or fixed relay services with the loss of 2.310 through 2.390 GHz. Some existing fixed activity and the "weak signal" activity was able to remain for a while within the old band plan. Whenever we adopt a new band plan for our region, we submit it to the American Radio Relay League, Inc. (ARRL) to be included in national band planning efforts.

The members of SCRRBA are clubs and individual amateurs who construct and operate mobile and fixed relay amateur systems. These systems generally are available for normal operation 24 hours a day. Their fixed relay equipment is generally constructed and operated to provide a communications (and data) link between fixed points. The points of communication for these fixed relay stations do not change in the normal course of system operation. The typical systems are constructed with equipment manufactured for the commercial communications industry. This equipment is then modified for operation in the amateur band, and generally improved with devices developed experimentally. Our members use tools and equipment developed from a variety of sources. The experimenter amateurs (see San Bernardino Microwave Society) often develop techniques and devices which can be adapted for use on our mobile relay and fixed relay systems. These modifications result in system performance far above that of the original equipment.

Systems developed by our members are generally used for continuous on-going daily communications rather than the intermittent or random nature of HF communications more often associated with Amateur Radio operations. Various types of communications and control data are sent over these systems. The members of most systems are "control" operators who are able to configure their system to meet any particular operational need. The control systems built to do this are all of amateur design and manufacture. There are no commercial equivalents that could be adapted to our needs. These systems can become quite sophisticated and complex. The experience we gain building and operating these systems allow us to have communications tools far superior to and far more flexible than any commercial system could ever be. We have the communications equipment in place. From long experience we know how to make our systems reliable. We have these systems running continuously which also allows us to develop communications skills. These systems, and the tools and skills residing within our membership provide a huge resource of communications capability. This resource is regularly tapped to provide many different types of public service communications. This resource is of tremendous value in an emergency[1]. These Amateur Radio systems often have a service area that extends throughout the Southern California area and into neighboring states. This capability allows us to provide public service communications into and out of a disaster area when the commercial systems are not functioning[2]. These systems communicate into and out of the region on fixed point-to-point links.

During the 1980's, the need for point-to-point operation in the 2.3 GHz band became quite obvious as the frequencies allocated (by band plan) in the lower UHF bands became full to overloaded. The rapid increase of packet (digital) radio "backbone" (point-to-point or multipoint) operations placed a serious burden on this already overloaded spectrum. Amateur Television operators also began to build point-to-point relays for their activities. There is no usable spectrum in the 420-450 MHz amateur band for television relay[3]. TV and FM fixed relay operations in the 902-928 MHz band were begun, and then rapidly curtailed[4].

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[1] Most commercial and public communications are disrupted or overloaded during most any type of emergency. When the emergency is as severe and widespread as the recent Los Angeles earthquake, Amateur radio is often the sole source of communications for officials and the public alike. Many of our members' systems were heavily used during the earthquake aftermath. Many operated nearly continuously.

[2] The telephone system was shut off to incoming calls from out of state for many days after the recent earthquake. The area shut off for the first day or two was nearly ten times that actually affected by the earthquake. This meant that relatives and officials in areas outside Southern California could not call in on the telephone to areas where there was no damage at all. Our members' systems handled hundreds of calls each from people all over the southwest who could not call their relatives and friends in Southern California, an area of some 20 million people.

[3] Television relay describes fixed point-to-point use. Regular Amateur TV operations, while generally occurring from fixed home stations, are considered as "mobile" activity for the purpose of this submission.

[4] The 902-928 MHz band is essentially unusable due to the severe susceptibility to interference of Pacific Teletrac's "Automatic Vehicle Monitoring" system operating on the same frequencies. This system is a wideband pulse system which is not "spread" or otherwise enhanced. This means there are 8 MHz wide

The 1240-1300 MHz band is where the primary Amateur television "mobile relay" (repeater) activity takes place. All available TV frequencies in that band were occupied before the 902-928 MHz spectrum was even released to Amateur operations. The next higher spectrum available to the Amateur Service is the 2.3 GHz band. This band has the potential to carry quite large amounts of the point-to-point traffic (both TV and voice\message) presently on the lower UHF amateur bands.

The 2.3 GHz band is the highest Amateur frequency band that can be utilized using relatively conventional UHF techniques and equipment. This band is the highest amateur band that can effectively utilize co-axial transmission lines rather than waveguide[5]. The path performance of the 2.3 GHz band is sufficiently similar to the lower UHF bands to allow many amateur systems to use the 2.3 GHz band to replace their UHF paths without adding (expensive) relay points. The minimum recorded path lengths in the point-to-point portion of the SCRRBA database are about 15 miles. The longest paths are very close to 200 (!) Miles. Typical path lengths are between 30 and 90 miles. Higher microwave frequencies would, at minimum, double the number of hops required in most cases. There is quite a bit of surplus commercial 2 GHz equipment available. Much of the equipment originally designed for light or medium density routes is practical to convert to the 2.3 GHz band. This equipment is relatively inexpensive, and makes widespread utilization of this band practical for many Amateurs. The equipment originally designed for high density routes is generally not usable due to its wide bandwidth requirements.

We must note at this point the past loss of 2.310 to 2.390 GHz. This spectrum was shared on a secondary basis by the Amateur Service identically to the remaining portion of the band. There was sufficient spectrum available to allow the use of surplus high density (wideband) microwave equipment. Much of this type of equipment was bought by a number of amateurs during the early 1980's. Their intent was to use this equipment to replace a number of the point-to-point systems operating on the lower UHF bands with a combined (multiplex) system. The conversion efforts were well under way when the portion of the band allocated for this use was withdrawn from shared service by the Government. The remaining portions of the band would not support the bandwidth requirements of the equipment. Virtually everything except a few filters was scrapped. This loss of this spectrum caused quite a loss of enthusiasm and interest (and money) in this part of the country.

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receivers on virtually every communications site in the region which cannot tolerate the presence of a carrier (or equivalent) of ANY discernible strength within its passband. The 902-928 MHz band is shared with numerous services, and the "AVM" licensees have a higher legal priority than does the Amateur Radio Service. This renders that band virtually unusable for TV as well as most other fixed relay systems.

[5] Waveguide typically costs an order of magnitude more than co-axial cable and requires a much more expensive installation process. Most amateur point-to-point equipment is located on commercial communications sites where a waveguide installation would be both lengthy and costly.

There is quite a bit of existing Amateur activity in the 2.3 GHz band, much of which is noted above. (See Appendix 1 for an extensive analysis) There is also Amateur Satellite activity in the portion of 2.400 through 2.402 GHz. This small chunk of spectrum may satisfy the Amateur Satellite Service needs of today, but it leaves far too little spectrum to allow any meaningful development of satellite activity on 2.3 GHz. There is enough spectrum for a bit of telecommand and telemetry activity, but far too little to build satellite based communications systems[6]. There is quite a bit of "weak signal" amateur activity centered at 2.304 GHz. The operations there are experimental in both equipment and propagation mode. These activities vary from moonbounce to tropospheric duct to scatter mode communications. Most of the equipment operated here is of quite high performance. Many stations have 100 watt or higher power amplifiers, and receivers with less than 1dB NF. These activities are intermittent in nature but occur regularly[7].

The SCRRBA database currently shows 22 conventional medium bandwidth point-to-point terminals coordinated on the 2.300-2.303 - 2.305-2.310 and 2.390-2.400 GHz band segments. There are 10 Digital (only) narrowband terminals shown. The database also shows 8 TV point-to-point terminals coordinated on the 2.410-2.450 GHz band segment[8]. Many of these terminals are located on mountaintop commercial communications sites. These locations provide an opportunity to operate these terminals across rather long paths. It should be noted that these are listings of coordinated activities. There is no listing in our database for activities planned by various groups but not yet coordinated. Submissions on this spectrum reallocation matter made by these groups will be likely to contain details of both their existing and planned activities. As a result, the numerical data we are submitting may not exactly match their submissions.

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[6] See comments of the Radio Amateur Satellite Corporation filed on the NTIA preliminary report (Comment 028). RASC is also likely to file comments to the FCC on this matter.

[7] More details on this "weak signal" activity can be found in Appendix 1 and submissions to the NTIA (and submissions to the FCC) from the Amateur groups particularly focused on these modes. (See SBMS- NTIA comment 013, WSVHF-MS - NTIA comment 020, ARRL- NTIA comment 036)

[8] The medium bandwidth terminals are typically 1 watt transmitters of 800Khz occupied bandwidth with receivers of 10Db NF. Some medium bandwidth terminals have combined analog and digital traffic. The antennas vary from 6 foot dishes down to medium sized horns. The digital terminals are typically less than 200Khz bandwidth, and usually 1 watt transmitters. The TV terminals are typically 1 to 10 watt transmitters, with 16Mhz occupied bandwidth. The receivers have 5 to 10 dB NF. The antennas used are similar to those above. See Appendix 1

ANALYSIS

The NTIA has directly failed in its assigned tasks:

1: ".. avoid excessive disruption of amateur use of existing Federal Government frequencies"[9]

2: ".. consider the extent to which commercial users could share the frequencies with Amateur Radio licensees"[10]

3: Determine substitute frequencies "if the reassignment will disrupt the existing use of a Federal Government band of frequencies by amateur radio licensees"[11]

Discussion of 1:

The NTIA preliminary report (and the Budget act) accurately depicts the existence of the Amateur service and its basic structure. The report accurately acknowledges that the Amateur Radio Service can and does supply emergency communications and many other public service activities. The proposed spectrum re-allocation will seriously hamper the continuation and growth of a substantial segment of this emergency communications capability. The report does not list the actual activities described above and in appendix 1, except for the amateur satellite activity. This makes the report quite incomplete! How can the NTIA conclude anything about Amateur operations when they did not determine any actual or potential activity? How can the NTIA determine the extent to which a change in spectrum allocation will affect amateur operations when they do not know what the amateur operations are? The NTIA report explains amateur radio activities in general, as well as giving a nice and reasonably accurate picture of the Amateur service as a whole. Unfortunately, this nice and proper foundation was not used to draw a proper set of conclusions.

The NTIA report states[12] that "Overall use (of 2.3 - 2.45GHz) by the amateur community cannot be easily determined...". We have reviewed all the comments filed with the NTIA on their preliminary reallocation report. We have reviewed much of the amateur related material submitted to the NTIA as testimony and information which was (apparently) used to produce the preliminary report. The ARRL accurately stated the general case to the NTIA[13]. The NTIA has apparently chosen to decide that since the "Repeater Directory"

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[9] Omnibus Budget Reconciliation Act of 1993, Section 113.a.1.C.iii

[10] Footnote 9 Supra, Section 113.a.3.C

[11] Footnote 9 Supra, Section 114.b.2.E

[12] NTIA Preliminary report Appendix E page E-7

[13] See NTIA Preliminary Report Section 4 footnote 30 "ARRL testimony to the NTIA SPAC"

does not show activity at 2.3 GHz, that the band must be "very lightly used[14]." The associated conclusion[15] that the Amateur community can satisfy its spectrum needs in the remaining half of the spectrum is entirely specious and should be ignored.

The amateur activity in the 2.3 GHz band cannot be easily determined from a published book like the "repeater directory". As clearly explained by the ARRL[16], The "repeater directory" does not represent a database of amateur operations at all. It does not represent overall or complete activity on ANY band, let alone the 2.3 GHz band!. The fact that this easy source of information does not address the data needed to report on amateur activities on 2.3 GHz does not excuse the NTIA from making a reasonable attempt to satisfy the mandate in the Budget act! Many sources of information were and are available to the NTIA (and anyone else) with just a little bit of research. The ARRL is the easiest and most available point of contact. We have not been able to find any point where the ARRL was asked to supply an accurate overall picture of 2.3 GHz amateur activity. Indeed, the ARRL testimony above explained quite a bit about the basic amateur activities in the band. The ARRL is not the sole point of contact (although it is the most visible) with the Amateur community. The ARRL, or anyone willing to read a few amateur periodicals, could determine a few specific amateurs and amateur organizations to contact about the 2.3 GHz band. The ubiquitous repeater directory lists the frequency coordination councils all around the country. The ARRL board of directors has committees specifically geared to VHF-UHF amateur activities. The ARRL division directors, whose individual phone numbers and addresses are published each month in the ARRL journal QST, could easily supply names and addresses of persons to contact within each of their divisions. This journal, QST, and many other amateur publications are available in any amateur radio store, and on many newsstands all around the country. A written request for information to virtually anyone found through these methods would have produced (given a little time) the information which is only now becoming obvious to the NTIA and others though the public comments on the reallocation process. Much work could have been saved and much better relations could have been maintained if effort beyond "easily determined" had been put forth. The NTIA report is otherwise quite well done and self explanatory. It is unfortunate that it fell down so badly in this area!

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[14] NTIA Preliminary Report Section 5 page 14 paragraph 2 and Section 4 page 4-18 paragraph 1

[15] Footnote 10 Supra, last line

[16] See NTIA Preliminary Report Section 4 footnote 30 "ARRL testimony to the NTIA SPAC"

Discussion of 2:

This is not a simple matter as the actual commercial service and mode of emission is not determined nor is it determinable (that is a purpose of this FCC NOI). The NTIA report does not explain or show how commercial users could share with amateur radio. No study was reported, no analysis given. We can only surmise from the NTIA report[17] that it was assumed that sharing amateur operations with Government Radiolocation (RADAR) was equal to sharing amateur operations with commercial operations. Nothing could be farther from the truth. The experience described above with Pacific Teletrac[18] on the 902-928 MHz band is a typical example of how such sharing will NOT work. Several non-amateur commenters on the NTIA preliminary report indicate their serious doubts that sharing could be accomplished successfully. The basic nature of both communications services places them at odds. Commercial entities see the Amateur Service as an easily ignored annoyance. On the lower UHF and VHF amateur bands, we regularly "chase" down interference from commercial equipment that is malfunctioning and generating widespread interference. The most common attitude heard from the commercial licensee or service vendor is: "well -- maybe we will look at it next week- if we have time"! Another typical situation is the "cable companies." Most cable companies were totally unwilling to or downright incapable of repairing cable leakage, and often belligerently blamed the Amateur for wiping out their cable system. When the FCC rules were changed to provide both leakage specifications and severe penalties for their violation, the cable companies began to at least listen to a complaint. Today, there are still regular occurrences of cable leakage interference to amateur activities which are very difficult to get solved.

In order to evaluate potential spectrum sharing, we must also consider the nature of a proposed service. There is a FCC Part 15 allocation at 915 MHz and at 2,450 MHz for various types of unlicensed devices. Many of these devices are intended for or capable of use in a residential environment. These devices are operated by citizens who neither know nor care that that they are operating a radio transmitter and receiver. These citizens will not understand why their wireless telephone or wireless LAN goes berserk when the next-door amateur operates his transmitter. They will understand even less that these devices render the amateurs' equipment useless. The citizens' recourse is to return the devices to the vendor for a refund, and to give-up their new toy. The amateurs' recourse is to cease operations. This is simply unacceptable. This is contrary to the basic concept of the spectrum reallocation improvement in the Budget Act. Such spectrum sharing will NOT benefit the public. The reallocated spectrum is most likely to be issued to some type of PCS service. This makes a high probability that amateur equipment and commercial equipment could be co-located as in the example of 915 MHz above. It is our considered position that Amateur-Commercial spectrum sharing is impractical, unwise and to the severe detriment of the Amateur Service.

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[17] NTIA Preliminary report Section 3 page 3-6 paragraph 1, last two sentences

[18] See footnote 4 Supra

Discussion of 3:

The Amateur Radio Service has been successfully and courteously sharing Government VHF, UHF, and Microwave spectrum for nearly 50 years.[19] Much of the government spectrum usage is located away from populated areas which minimizes the interference potential. We have local, regional, and national organization which make us easy to find to resolve an interference problem. Within our service, there are regularly published lists (the Callbook) of the name and address of EVERY amateur in the USA. We transmit station identification regularly, both by law and by choice. This also makes us easy to find to resolve an interference problem. Virtually NO other communications service has stations so easy to identify, and NONE of them has technically competent personnel actually operating their transmitters. When was the last time you had to track down interference generated by a commercial 2 way radio, or a cellular telephone? It is nearly impossible to do! The amateur service can share with many Government operations. We can effectively utilize "guard bands" which are often placed between types of service. We can minimize interference to and from the adjacent spectrum assignments.

We cannot find any evidence within the NTIA report that any study of replacement spectrum was made. We submit (as stated above) that we can share effectively with the Government. We attach an appendix (1) which outlines in detail a structure of amateur spectrum uses and needs. This information can be used to compare to Government spectrum use between 2.2 and 2.45 GHz in an effort to find replacement spectrum for Amateur use. We feel that the information we are providing has sufficient flexibility and is sufficiently specific that the NTIA should be able to find us enough spectrum to at minimum, replace that which is currently being "reallocated," and should in all likelihood, be able to find sufficient spectrum to replace a significant portion of the spectrum lost in the last "reallocation" (the loss of 2.310-2.390 GHz) Should the NTIA find, and the FCC allocate adequate replacement spectrum, we are quite certain that the vast majority of amateurs will support the reallocation plan, rather than strongly oppose it as we do now.

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[19] NTIA Preliminary Report Section 3 page 3-6 paragraph 1 and associated footnote 20

Discussion of the specific points of inquiry of the FCC NOI. (All points are limited to discussion of the segments from 2.300 through 2.450 GHz.)

a) (.. What is the potential of the spectrum.... ?) The spectrum identified has limited commercial potential. The spectrum is substantially separated from other commercial and "PCS" allocations. The proposed allocations have no "paired" spectrum (at this time). There is already significant commercial use of much of the proposed spectrum by Part 15 users, and their uses are anticipated to increase significantly[20]. This limits the "available" spectrum (at 2.3GHZ) to 10 MHz. This 10 MHz, a doubtfully useful allocation at best, is currently allocated to Amateur Radio on a secondary basis. The Amateur community is expected to vigorously oppose reallocation of this (and other amateur) segments.

b) (... what restrictions should apply?) One item that is clear and applies to any and all portions of spectrum reallocated. The rules must be written so as to encourage or require interference resistant modes of operation. There should be NO protection offered to interference susceptible wideband operations (similar to Pacific Teletracs 902-928 MHz operations) Reasonable power limitations and some radius of operations limitations as described by the NTIA report should be sufficient to protect adjacent Government operations (at 2.380 GHz) Use of this spectrum for high power wide area operations (such as paging) should be restricted in favor of the more localized or "cellular" approach. This will minimize interference to many parties and facilitate the use of the spectrum by more users within a given service area.

c) (will the.. reallocation avoid excessive disruption..... of amateur operations...? and ... is the 2 MHz .... for amateur satellite sufficient?) We most emphatically state NO! The preceding pages (and appendices) document amateur activities in this band. Several types of amateur operations will have to be curtailed, and some will be totally eliminated (if the 2.300-2.310 GHz segment is similarly taken). The 2 MHz for satellite operations is a pittance. The Satellite operations are relatively weak signal and often use terrestrial high power transmitters. This poses interference potential to adjacent operations and those operations pose interference potential to the terrestrial satellite receivers (most commonly through excessive sideband noise). Any adjacent operations should be limited to an assigned occupied bandwidth of 50 to 100 KHz to minimize sideband noise actually generated on frequency in the satellite segment. This bandwidth limitation will also encourage the use of filtering on the adjacent systems receivers which will aid in protecting them from high power satellite (terrestrial) transmitters.

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[20] See comments on NTIA preliminary report by Larus Corp. (Comment 004); Utilities Telecommunications Council (Comment 034); Telecommunications Industries Association (Comment 038); Western multiplex Corp. (Comment 042) and others

d) (will. 'new services' ... be able to share with ...amateur operations....?) In general, NO. We have explained in detail above many of the problems with shared operations. It would be possible to have certain types of amateur and commercial operations share spectrum, but, it is our considered opinion that this would place an excessive regulatory and coordination burden on the FCC and on both services. The Amateur service MUST be above the commercial service in any allocation scheme, or the amateurs will simply be forced out. We can visualize how amateur fixed point-to-point services might effectively use the same spectrum as low power spread spectrum or medium bandwidth digital commercial devices intended for localized uses. [21] Commercial operations would have to be excluded from centralized common communications sites, and amateur operations using formats similar to the commercial ones would have to be similarly excluded. Such a structure could be created, but it would take significant changes to the amateur rules, in particular, the assignment of a type of communication and a type of communication format to a particular piece of spectrum.

e) (what is the impact of ISM and Part 15 on the use of 2.402-2.417 GHz?) The precise impact cannot be determined until the types of commercial systems are adequately identified. The most likely to succeed is spread spectrum type systems. Unfortunately, spread spectrum devices are already in manufacture by some part 15 manufacturers.[22] This renders this portion of the proposed reallocation virtually moot as there is already commercial use of the spectrum identified. Any type of commercial system able to withstand interference from existing Part 15 systems (in particular microwave ovens) will, in all probability, be sufficiently robust to cause harmful interference to both other Part 15 users and to amateur users on the same and adjacent spectrum.

f) (.. public safety systems...) We believe the available spectrum is both insufficient and too susceptible to interference to be useful for public safety communications.

g) (..biomedical devices..) There was insufficient data provided in the NTIA report to determine what level of interference bio-medical equipment could withstand. It is clear that no spectrum in the 2.300 GHz band will be "interference-free".

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[21] An example of a service that would NOT share effectively is the Intelligent Highway system. While we support the basic concept, this activity belongs on much higher (and probably exclusive) spectrum. The potential for interference is less the question than the effect of interference (on the IVHS system). Amateur point to point transmitters operating from an elevated location, as is common, using a dish antenna to concentrate the signal, could easily develop adequate signal on a highway several miles away to saturate out (or "capture") the desired IVHS signal with potentially disastrous results.

[22] see footnote 20 Supra

h) (.. delay in licensing to allow spectrum pairing...) We believe a delay to enable pairing is desirable. We also believe that a delay in releasing the spectrum at 2.300-2.450 GHz is highly desirable. This delay will give the NTIA time to complete its tasks under the Budget act and find replacement spectrum for amateur operations. Adequate replacement spectrum will turn the present vocal amateur opposition to the re-allocation into support.

CONCLUSIONS

We state that the NTIA has FAILED its task in several ways. We state that this spectrum (2.300 through 2.450 GHz) is NOT available for reallocation as a result of this failure. The failure to follow the instructions in the Budget act will result in irreparable harm to the amateur community. Should the FCC choose to reallocate any of this spectrum to other than amateur radio, the FCC will be in similar violation of the instructions in the Budget act.

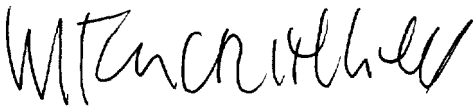
The FCC has stated in previous actions (notably the 220-222 MHz issue) that amateur radio has much other spectrum to use, and listed spectrum including the 2.300GHZ band. We feel that this argument has long since been used up. The FCC has removed 220-222, 1,215-1,240, and 2,310-2,390 MHz from amateur service in recent history. The allocation of 902-928 MHz does not even come close to replacing the already lost spectrum. 902-928 MHz is essentially unusable as explained above.
Continued reallocation of amateur spectrum must be considered a serious breach of faith between the FCC and the amateur community.

We have identified the failure in procedure which caused this problem. We have suggested general solutions to the problem. We have supplied data from which to build a mutually acceptable solution. We ask that the spectrum in question NOT be allocated to any other than amateur operations until such time as these matters are resolved.

Respectfully submitted

For the SCRRBA Board and Technical Committee

M. Robin Critchell Board Member



Attachment: 1: Appendix 1 2.3GHz band analysis
2: present SCRRBA 2.3 GHz band plan

Appendix 1

AMATEUR 2,300 MHz OPERATIONS OUTLINE

SECTION 1

OUTLINE OF PRESENT AMATEUR ACTIVITIES IN THE 2,300 MHz BAND

1: WEAK SIGNAL/EXPERIMENTAL

Presently occupies 2303.75-2304.75 MHz

Activity limited to transmissions of 3 KHz or less bandwidth

Surrounded by small blocks of 250 KHz and 750 KHz wide (amateur) assignments for point to point where bandwidths used are less than 50 KHz. This is intended to give some protection from excess sideband noise generated by wider bandwidth transmitters.

Use of high power is common.

Highly directional antennas are used exclusively.

Very high performance receivers are commonly used. These receivers usually do not have filters in front of them for the same reason NASA does not use filters - cost and loss of system performance .

These stations communicate by many propagation methods - tropospheric ducting and scatter; low atmospheric inversion ducting; refraction and reflection off natural objects (mountains); EME (moonbounce); to name a few.

Many of these propagation modes result in very weak signals. An increase in the noise floor of even a dB or two from commercial spread spectrum transmissions, or from microwave ovens will likely render many communications impossible.

There is some activity on EME using approximately 2449.5 MHz . The use of microwave oven magnetrons makes the generation of high power practical. Most of the time the highly directional antennas used are pointed well above the horizon. This means they do not hear very much microwave oven interference- (except from their own home!)

2: SATELLITE ACTIVITY

The AMSAT people are in a better position to supply information on this.

They presently operate at least 3 frequencies between 2400 and 2402 MHz.

The satellite activities are likely to conflict with typical weak signal activities for a variety of reasons. The satellite signals are definitely "weak" so the same protections need to apply to their receivers (space or terrestrial) as do the regular weak signal operations. Note that both the weak signal and satellite operations often require transmitting high power. Many Satellite operations are cross-band which reduces the likelihood of the satellite operator realizing that he may be causing interference (to weak signal or other operations.). Satellite operations are usually unable to change frequency to alleviate an interference problem as the satellite itself is not frequency agile (nor should it be). Doppler shift to and from the satellite might actually cause a satellite operator to move onto an existing communication without realizing it. A weak signal operator may easily saturate a satellite transponder as it comes over the horizon without ever knowing about it. Good planning requires separating the types of activity (as they are now on most bands) to minimize mutual interference.

3: POINT - TO - POINT

Within this classification there are only two activities sufficiently different to justify a separate analysis: Television relay and analog/digital "message" relay.

The general classification of "point-to-point" refers to a system of fixed points of communication. Some systems operate "point-to-multipoint" but are not otherwise different. These systems usually operate 24 hours a day , although the transmitters may not be on continuously, they are ready to transmit instantly. These systems operate on specific frequencies, generally assigned by the local frequency coordinator, and are not frequency agile. These systems universally need to have similar information sent in both directions simultaneously along any one path.(the present store and forward operation of slow speed "packet" radio common on the lower bands is not applicable here. There is too much work and cost to install a system in this band to not have it transmit information in both directions at the same time, with the resultant huge increase in data throughput. The actual message content need not have any relationship to the message going in the other direction.) This gives rise to the need for adequate frequency separation to allow this "duplex" operation. These systems generally are constructed to have as reliable as possible overall operation. They do not need or want high power as the few dB that is practical to obtain makes too little difference in overall system performance. High performance receivers are often used to insure good path reliability. These receivers are protected by filters sufficient to reject their own transmitter operating on the same antenna. These filters are more than sufficient to reject near-band or out of band interference of any normal magnitude. (they cannot, of course, reject on-frequency interference such as spread spectrum or vehicle monitoring or the

local RCC paging transmitters which might be assigned the same frequencies under the "Reallocation" plan). Antennas used vary substantially based upon path needs and cost. Point -to-multipoint systems may utilize an omnidirectional antenna, or several directional antennas if warranted.

Most systems can be classified by occupied bandwidth. As you can see from our present band plan, we allocate spectrum for Bandwidths up to 50 KHz and between 50 KHz and 1 MHz. There is not enough spectrum on the 2300 MHz band to allocate the 1 to 10 MHz bandwidth systems except for Television. These wider bandwidth systems are restricted to 5600 MHz and above.

A: Analog/Digital relay systems.

This is anticipated to be the single largest use of the 2300 MHz band within about 10 years (if we have any of the band left to use by then)

These systems require a duplex assignment with a minimum spacing of approximately 40 MHz and a maximum spacing of approximately 150 MHz. These limits vary with the type of equipment, the cost of the duplexers, and the bandwidth of the antenna. Use of separate transmit and receive antennas is a luxury effectively unobtainable. Most of these systems are on commercial communications site whose owners charge (LARGE) fees for each dish type antenna.

Present systems are on the segments just above and below 2304; and those are paired with 2390 to 2400 MHz. (90 MHz spacing) These systems were constructed with equipment originally designed for both 50 and 100 MHz spacing.

There are various bandwidths in use: 38, 112, 200, 400 and 800 KHz are typical. The frequency coordinator will usually assign like bandwidth systems to the same or adjacent frequencies within a band segment to maximize band utility.

Systems contain both digital and analog information- often simultaneously through the use of subcarriers or digital multiplexing.

Modulation may be applied either digitally or by the more conventional FM analog method. We anticipate some SSB multiplex systems to be constructed, but most non-FM systems will be digital radios. This is not to be confused with packet or digital traffic. Digital radios in this context means that the information from all the multiple inputs (voice or data) are converted to one digital data stream and then applied to the transmitter. The widest system that would fit in the present band plan is about half of a "T1" system. We may choose to modify the band plan to increase the upper limit of 1 MHz to the 1.566 MHz needed for a full "T1" circuit. This is now unlikely to occur until the fate of the 2300 MHz band is finally decided

Typical transmitter powers are between 0.1 W and 10W

B: Television Relay systems

These systems require duplex operation, and if done in-band, require a minimum spacing of approximately 50 MHz.

Present and planned TV systems use the NTSC format or digitally compressed NTSC format.

All present and most planned systems are FM (in this band)

The occupied bandwidth is generally considered to be 20 MHz. Successful operations do occur where two FM TV transmitter channels are separated by 15 to 18 MHz. This is due to the sideband energy of the unwanted signal being perceived as noise on the desired channel. If the desired signal is of sufficient strength, this noise is overcome acceptably. If the adjacent signal is narrowband, nearly all of its energy and its carrier will appear in the TV receiver passband causing unacceptable interference.

Voice (or data) are usually sent simultaneously with the use of a subcarrier. Typically the subcarrier is 4.5 MHz although 5.0, 5.5 5.8 and 6.2 MHz may be used, and sometimes simultaneously. It is necessary to transmit two separate subcarriers for stereo, or for separate information to be transmitted.

There are three common system designs for 2300 MHz TV relay systems. Most present systems operate crossband, i.e. a relay point will receive the output of a 1240, 902, or 420 MHz system, and retransmit it on 2300 MHz aimed at the next site in the chain. There it will be received (on 2300) and retransmitted on 1240, 902, or 420 MHz. This allows the least expensive equipment to be used at each site and makes the best use of the 3 "channels" presently available. These 3 channels are too close together to make it practical to construct the second type of system, the in-band duplex system. (It should be noted that there was adequate spectrum for in-band duplex TV relay before we lost the 2,310 to 2,390 MHz portion of the band)

The in-band duplex system operates essentially identically to the analog/digital systems described above. A TV signal is sent both directions across a path simultaneously, and the pictures are generally completely independent. The system may also be configured as a repeater where the received signal is simply passed on. This system is quite different from a more conventional repeater as the receive antenna may be pointed in a totally different direction from the transmit antenna.

The third type TV relay system is intended for portable or mobile use. The term "mobile" in this case is most likely to be in a helicopter or airplane. Many of our TV systems are made available to or are directly associated with a city or county government agency. The airborne views of a major incident, parade or other large activity that we all are accustomed to seeing on the evening TV news are received by the TV station on their 2000 MHz "ENG" microwave system. These same views, delivered in real time, (and focused on the overall incident, not just the part that makes "hot news") are of tremendous strategic value to the community agencies who have to deal with the problem. Amateur TV operation from city helicopters have already occurred many times on the lower frequency bands. One frequency usable for this type service in the 2300 MHz band is essential to allow the Amateur community to effectively continue this important public service role.

SECTION 2

SUMMARY ANALYSIS AND IDENTIFICATION OF SPECTRUM REQUIREMENTS

1: SHARED SPECTRUM

These comments are based upon the basic premise that the Amateur service CANNOT share at all with any commercial service, even if we hold the primary allocation status which places us above the commercial allocation. The Part 15 uses on 902 MHz are an excellent example of why this is true. Please visualize explaining to your neighbor that he cannot use his new wireless telephone or wireless LAN gadget because it causes interference to your amateur operations. Worse yet, visualize explaining to the local cable company that they cannot sell or use their new wireless interactive cable transmitters because they cause interference to your amateur operations!. The incredible battles which occurred throughout the country over amateur interference to and from the 145.25 MHz cable TV channel are example enough. No rule can be effectively enforced that places a commercial service below a purely voluntary non-commercial service. The voluntary service will be effectively run out of the spectrum by being forced to stop the commercial operations which cause interference on a single case-by case basis--- one that neither the FCC nor the Amateur service has the staff or money to do!

These comments are also based upon the proven premise that the Amateur service CAN effectively share spectrum with Government operations. We have been doing so for more than 50 years, and the NTIA states in its preliminary report that such sharing has been quite satisfactory. This success is due, in part, to the relatively light spectrum usage by the Government, and their use of systems which are not particularly susceptible to interference (RADAR in particular). This success is also due to the Government operations not generally being located in areas with high populations or immediately adjacent to residential environments. The Amateurs contribute to this success by being cooperative, easily identified, and technically competent to intelligently resolve an interference problem (usually immediately) (these attributes do NOT describe a commercial or a Part 15 user)

2: WEAK SIGNAL

Terrestrial and earth to/from space. Maximum authorizable amateur power required. Total spectrum required 1.0 MHz contiguous, far away from 2,450 MHz Microwave Ovens and ISM.

Recommended frequencies: 2,304 MHz ; between 2290 and 2321 MHz ; 2320 MHz. (2,320 MHz appears to be a center of internationally available amateur frequencies as listed in the ARRL comments appendix). Any such assignment must retain right to full 1500 W PEP (this could represent as much as +60 dBW ERP!) and must be able to aim up for moonbounce.

3: SATELLITE

All Earth to/from Space . Maximum authorizable amateur power required.

Total spectrum required 10 to 20 MHz in two non-contiguous (and may be non-identical) blocks. One block must include 2400-2402, recommended total there of 10 MHz. Second block of 5 to 10 MHz may be located at 2450 and used for uplink only (if sufficient spacing provided from terrestrial TV operations nearby)

2400-2402 may be barely sufficient today, but is wholly inadequate for near future. AMSAT's comments to NTIA indicate approximately 20 MHz needed, and this spectrum could be in two segments.

4: POINT-TO-POINT ANALOG/DIGITAL

All terrestrial - No earth- space. Power could be limited to 100 W PEP (NOT ERP!)

Total spectrum required is 24 MHz between 2,200 and 2,450 MHz. This must be in a minimum of two segments spaced by a minimum of 40 MHz and less than 170 MHz. This can be done in several smaller segments, but the minimum useful size of a segment is 1.6 MHz (effectively 2 MHz) These segments must pair within the spacing above, but need not be either adjacent nor of identical spacing. These frequencies can adjoin either or both the weak signal or satellite segments but cannot include these segments

The smaller the segments are, the less efficiently we can use them. If we must settle for several small segments, the total must be the full 24 MHz, otherwise we will essentially have nothing to work with after the first few systems are accommodated.

A power restriction to 100 watts PEP (NOT ERP!) would be acceptable, if needed, to facilitate sharing with Government operations.

5: POINT-TO-POINT TV

Terrestrial only- no earth/space. Power could be restricted to 100 W PEP (NOT ERP)

Total spectrum required is 60 MHz between 2200 and 2450 in 3 20 MHz blocks ("channels"), one separated by a minimum of 50 MHz from the other two. Having all three channels spaced out would be nice, but less spectrum efficient (two channels would fit in 35 MHz if adjacent, rather than 40) as explained above. If all of 2417 to 2450 is available for TV and not used by Satellite, two of the needed channels could fit in this space, provided that none of the analog point to point systems have to be sandwiched into the same space.

SCRRBA

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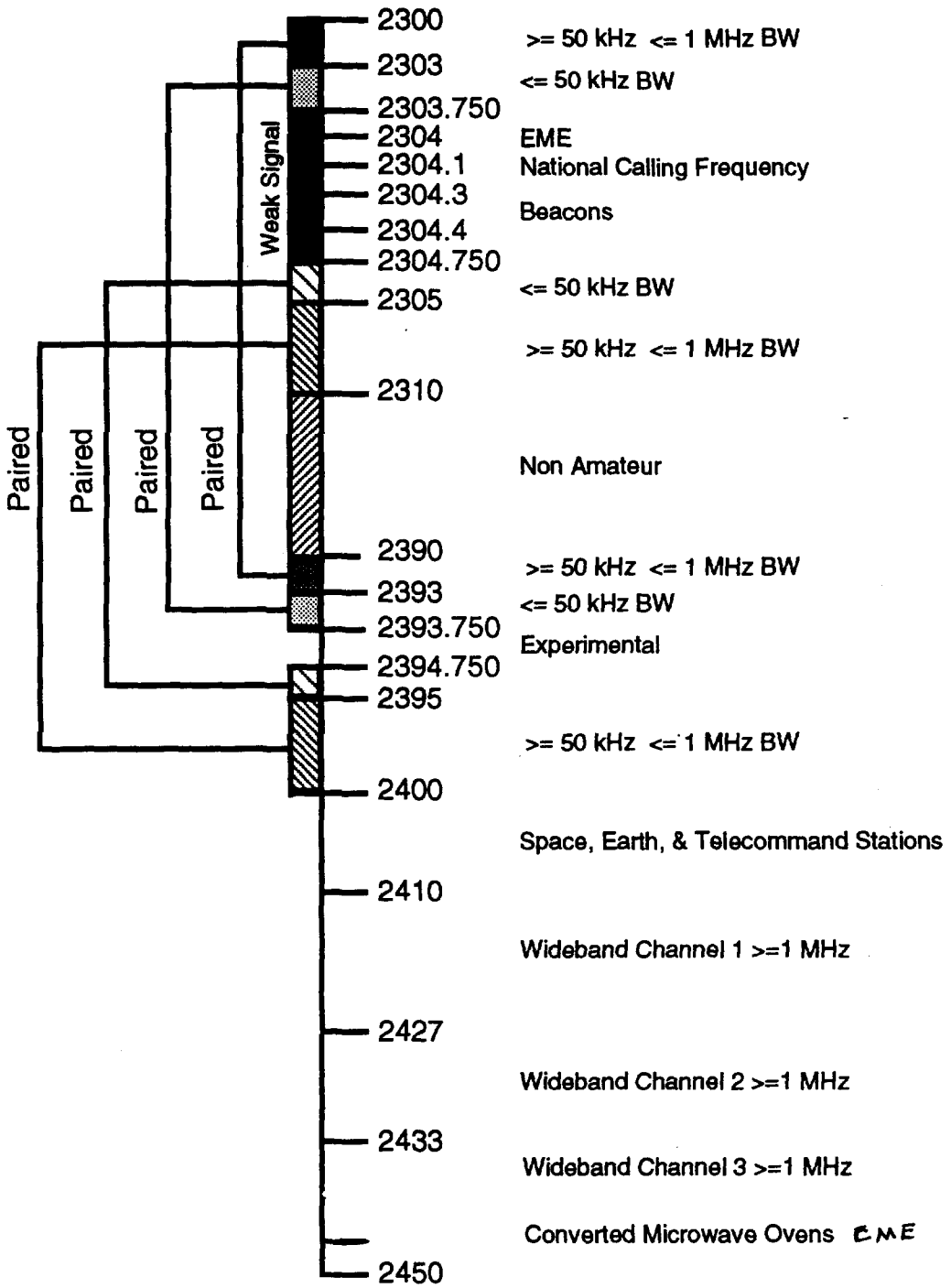

2300-2450 MHz Band Plan
Adopted 9-26-92
SCRRBA